



THE UNIVERSITY *of* EDINBURGH

## Edinburgh Research Explorer

### Right at the left edge: initial consonant mutations in the languages of the world

**Citation for published version:**

Iosad, P 2010, Right at the left edge: initial consonant mutations in the languages of the world. in J Wohlgemuth & M Cysouw (eds), *Rethinking Universals: How Rarities Affect Linguistic Theory*. Mouton de Gruyter, pp. 105-138. <https://doi.org/10.1515/9783110220933.105>

**Digital Object Identifier (DOI):**

[10.1515/9783110220933.105](https://doi.org/10.1515/9783110220933.105)

**Link:**

[Link to publication record in Edinburgh Research Explorer](#)

**Document Version:**

Publisher's PDF, also known as Version of record

**Published In:**

Rethinking Universals

**Publisher Rights Statement:**

© Iosad, P. (2010). Right at the left edge: initial consonant mutations in the languages of the world. In J. Wohlgemuth, & M. Cysouw (Eds.), *Rethinking Universals*. (pp. 105-138). Mouton de Gruyter. [10.1515/9783110220933.105](https://doi.org/10.1515/9783110220933.105)

**General rights**

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy**

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact [openaccess@ed.ac.uk](mailto:openaccess@ed.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.



# Right at the left edge: initial consonant mutations in the languages of the world

*Pavel Iosad*

## 1 Introduction

This paper presents a typological overview of initial consonant mutations (abbreviated: *ICM*) — pretheoretically, changes in the first consonant of a word which are not obviously caused by the phonetic / phonological context. They are relatively well-known from the modern Celtic languages such as Welsh (Ball and Müller 1992) and Irish (Ní Chiosáin 1991; Green 2006). The main goals of this paper are as follows:

1. Provide an overview of initial consonant mutation and initial consonant mutation-like phenomena attested cross-linguistically;
2. Examine whether initial consonant mutation can be thought of as a separate phenomenon or just a special case of (morphologically conditioned) phonological alternations;
3. Make some typological generalizations over initial consonant mutation (as long as it is possible on such a small set).

The paper is structured as follows. In Section 2, I propose an overview of initial consonant mutation cases attested cross-linguistically and try to define the concept of mutation more clearly. Section 3 presents a fuller inventory of languages exhibiting initial consonant mutations (or initial consonant mutation-like phenomena). Section 4 considers some issues in the phonological exponence of initial consonant mutation, with special reference to autosegmental approaches. Section 5 discusses factors which trigger mutation. Section 6 contains a brief discussion of initial consonant mutation typology. Section 7 concludes.

## 2 Overview of mutations

Initial consonant mutations are best known from the (Insular) Celtic languages Irish, Scottish, Manx, Welsh, Breton, and Cornish. Here, I will use

Welsh (see Morgan (1952); Thomas (1996) for very complete overviews) to illustrate some mutation types. The essence of the mutation process is that, in some morphosyntactic contexts, words appear with a consonant different from their citation form. This is shown in (1).

- (1) a. *tŷ*  
house  
'house'
- b. *dy dŷ*  
2SG house  
'your house'
- c. *fy nhŷ*  
1SG house  
'my house'
- d. *ei thŷ*  
3SG.F house  
'her house'

In (1), the word for 'house' shows up with an aspirated stop [t<sup>h</sup>] in citation form (1a), with an unaspirated [d] after the 2SG possessive pronoun (1b), with a voiceless (aspirated) nasal [n<sup>h</sup>] after the 1SG possessive pronoun (1c) and with a continuant [θ] after the 3SG feminine possessive clitic (1d). In all these cases, the change in the consonant is contingent on the identity of the preceding lexical item. In (2), on the contrary, it is both the preceding item (call it the *trigger*; in this case, the definite article) and the morphosyntactic properties of the word undergoing the alternation (the *target*) that drive the mutation: only feminine singular nouns demonstrate the change.

- (2) a. *y cŷ*  
the dog (masc.)
- b. *y gath*  
the cat (fem.)
- c. *y cŵn*  
the dogs
- d. *y cathod*  
the cats

Finally, (3) exemplifies two cases where mutation is driven by rather general morphosyntactic conditions, rather than linear adjacency to a specific lex-

ical item. Specifically, the object NP *draig* ‘dragon’ undergoes mutation because of its position following the postverbal constituent, while the NP *dydd Llun* ‘Monday’ has its initial consonant changed because it plays the role of a temporal adjunct (Borsley, Tallerman and Willis 2007).

- (3) *Lladd-odd Emrys ddraig ddydd Llun*  
 kill-PST.3SG Emrys dragon Monday  
 ‘Emrys killed a dragon on Monday’

A fourth type of mutation is found in the isolate language Nivkh (Gilyak) spoken in the Russian Far East (Gruzdeva 1998; Mattissen 2003; Shiraishi 2006). Here, mutation is driven by the surface phonology, but blocked in certain syntactic configurations. Thus, (4) exemplifies a spirantization process: aspirated stops become continuants after (*inter alia*) another stop (irrespective of laryngeal specification). In (4a), the process applies when the verb is preceded by the object; but in (4b) it is blocked, since the verb is preceded by an adverb (verbal morphology is omitted in the source, which is Shiraishi 2006: 94).

- (4) a. *ɲ-imik tiv-ux lep ɾa-*  
 1SG-mother house-LOC bread bake-...  
 ‘My mother bakes bread in the house’  
 b. *j-ax nɪɲaɳ qʰo-ku-*  
 3SG-ACC a bit sleep-CAUS-...  
 ‘(She) let her sleep for a while’

I take these four types of phenomena to exemplify true initial consonant mutation. Before I give a fuller definition, I sketch some cases of what mutation is *not*.

First, I exclude cases where the first consonants of lexical words are caught up in across-the-board phonological processes whose domain happens to be larger than the (phonological) word. A well-known example is intervocalic spirantization in Tuscan Italian, or *gorgia toscana* (Giannelli and Cravens 1996). In this process, the voiceless stops /p t k/ are realized as continuants (normally [ɸ θ h], though there is a lot of variation). This process is active not only within words, but also in a clitic–host domain, as (5) shows:

- (5) a. *casa*  
 house  
 ‘house’

- b. *la [h]asa*  
 ART house  
 ‘the house’

I exclude such cases from direct consideration, since they do not target initial consonants specifically.<sup>1</sup>

I also refrain from considering most cases of consonant alternations involving the left edges of units smaller than the word; the ubiquitous post-nasal processes in Bantu and Austronesian languages (see Blust (2004) for a detailed overview of the latter) provide plenty of examples. Thus, in Kinyarwanda /r/ is realized as [d] following a nasal, as (6) shows.

- (6) a. *uru-rimi*  
 CL6.SG-tongue  
 ‘tongue’  
 b. *in-dimi*  
 CL6.PL-tongue  
 ‘tongues’

While such “mutations” are initial in some sense, they are very often due to normal word-internal phonological processes, and thus, again, do not target first consonants specifically. Moreover, it seems that the majority of these cases do not involve any morphosyntactic information, which plays a conspicuous role in cases like Welsh and Nivkh.<sup>2</sup>

Based on the observed diversity of initial-consonant phenomena, in this paper I operate with the following definition:

*Initial consonant mutation* refers to a change in the featural make-up of the initial consonant in a word, the context for which cannot be stated exclusively in terms of independently pronounceable phonetic or phonological entities.

This definition still leaves some leeway. In particular, what does it mean to be initial in a word? First, does it suffice to be initial only in some morphological forms? If yes, it is impossible to exclude Bantu languages like Tswana (Doke 1954), where a process normally associated with nasal-final prefixes is also triggered by a segmentally empty morpheme, as (7) shows.

- (7) a. *go bona*  
 INF see  
 ‘to see’

- b. *go m-pona*  
INF CL1.OBJ-see  
'to see him / her / it'
- c. *∅-pono*  
CL9-seeing  
'seeing'

Second, the concept of word is, of course, notoriously used with different meanings in various schools and with application to various domains.<sup>3</sup> I operate here with an intuitive notion of "word" as the actual instantiation of a lexical item, without committing to a particular stance. In the next section I list the languages which exhibit initial consonant mutation or initial consonant mutation-like processes.

### 3 The geography of initial consonant mutation

As mentioned above, the Insular Celtic languages present probably the best known case of initial consonant mutation (cf. any general overview, such as Ball and Fife 1993). It turns out, however, that initial consonant mutation or initial consonant mutation-like phenomena are attested more widely, at least in terms of linguistic areas.

#### 3.1 Europe

Apart from the Celtic languages, initial consonant mutation-like phenomena are attested in *Romance*. In particular, the so-called "syntactic doubling" (*raddoppiamento fonosintattico*) in the dialects of Italy is a case in point (see Loporcaro (1997) for a full overview). While many cases of *raddoppiamento* are constrained by surface phonology (cf. D'Imperio and Rosenthal 1999), the gemination of the initial consonant is often contingent only on linear adjacency to a trigger. In the examples in (8) (from Standard Italian),<sup>4</sup> the first consonant of the noun is doubled after the clitic preposition *a*, but not after the article *la*: triggering the doubling is an idiosyncratic property of certain lexical items.

- (8) a. *[k]asa*  
house  
'house'

- b. *a* [k:]asa  
 at house  
 ‘at home’
- c. *la* [k]asa  
 ART house  
 ‘the house’

Other dialects of Italy demonstrate more complex patterns: for example, in Neapolitan (Bullock 2001) initial [r] can double to [r:] or [d:], depending on its historical source (other historical voiced stops show similar behaviour):

- (9) a. *ti* [d:]ong-o  
 2SG.OBL give-PRS.1SG  
 ‘I give (it) to you’
- b. *tu me* [r]aje  
 2SG.DIR 1SG.OBL give.PRS.2SG  
 ‘You give (it) to me’
- c. *se mett-e a* [r:]ire-re  
 REFL.OBL put-PRS.3SG to laugh-INF  
 ‘(S)he starts laughing’

Again, the choice of the doubled form is not determined solely by the phonological context: both the properties of the trigger and some abstract properties of the target influence the surface form.

Other Romance varieties also exhibit assimilation phenomena at the left edges of words; an example is Canary Islands Spanish (Oftedal 1985).

## 3.2 Africa

Due to the wide spread of prefixation in African languages, various assimilation phenomena at the right edges of prefixes or left edges of roots are also extremely common, and some of these fall under the purview of our definition of initial consonant mutation. This overview will by necessity be very brief and certainly not complete.

### 3.2.1 *Atlantic*

The systems of West Atlantic languages, first and foremost Fula (Pula(a)r, Fulfulde) are also often recognized as *comparanda* for the Celtic mutations

(cf. in particular Ternes 1990). There is an extensive literature on the mutation systems of Fula varieties (Arnott 1970; Paradis 1992; Breedveld 1995); the system of Seereer-Siin is treated by Fal (1980) and McLaughlin (1994, 2000); otherwise, Storch (1995) presents the most complete overview to date.

However, the majority of West Atlantic languages demonstrate only initial consonant mutation-like phenomena. While root-initial alternations are indeed driven by morphology (i. e. the triggering of alternations is an idiosyncratic property of prefixes independent of their surface phonology), alternating consonants are only seldom word-initial: for instance, in Bedik (Ferry 1968) only one of fifteen noun classes has a zero prefix, while in Seereer-Siin (McLaughlin 1994) this number is five (of sixteen classes).

Fula (Anderson 1976; Paradis 1992; Breedveld 1995), on the other hand, presents a more interesting case, since this language has no (surface) prefixes and thus the root-initial alternations are always by necessity word-initial. The next two examples show Fula mutation in the nominal and verbal systems respectively.

- (10) a. *pull-o*  
Fula-CL1  
'Fula person'
- b. *ful-6e*  
Fula-CL2  
'Fula people'
- (11) a. *mi war-ii*  
I come-PERF.ACT  
'I have come'
- b. *mbar-ii-mi*  
come-PERF.ACT-1SG  
'I came'

In the nominal system, the noun class is sufficient as a predictor of the initial consonant: e. g. all nouns (as well as adjectives and determiners) belonging to class 1 (singular class for human beings) have a non-prenasalized stop as their first consonant if their lexical representation allows it (see below on the phonological exponence of mutation in Fula), while class 2 enforces continuants. In the verbal system, the initial consonant is determined by number and tense/aspect/modality features. In other words, Fula mutation can be described solely with reference to word-internal morphology —



unlike Celtic, where reference to word-external morphosyntactic contexts is unavoidable (see Section 5.2.1 for more extensive discussion).

### 3.2.2 (South-West) Mande

Most South-Western Mande languages (Mende, Kpelle, Loko etc.) demonstrate a process of initial mutation after a (historical) nasal (Kastenholz 1996; Vydrine 2004). There is some variation across the group: thus, in Kpelle the nasal is usually overt (12), while in Mende mutation is not triggered by any surface segment (13). The Mende examples are from Conteh, Cowper and Rice (1985).

- (12) a. *pólù*  
back  
'back'
- b. *m bólù*  
1SG back  
'behind me'
- (13) a. *ndòpói ngúléí gbàndi-á*  
child oil hear-PERF  
'The child heated the oil'
- b. *ngúléí mìa ndòpói kpàndi-á*  
oil FOC child heat-PERF  
'The child heated *the* oil'

### 3.2.3 Bantu and other languages

Various prefix-root assimilations are extremely common in Africa, including the Bantu languages. Thus, in the Southern Bantu languages alone (zone S; Doke 1954), Nguni languages demonstrate alternations after prefix-final nasals, while all the three Sotho-Tswana languages, as well as Venda and Shona have alternations after surface-empty prefixes. For lack of space I do not treat them in detail: it is rather obvious, however, that such cases do not involve processes specifically targeting word-initial consonants.

### 3.3 Asia

In this paper I concentrate on two languages of this area: Nias (Brown 2001, 2005) and Nivkh (Gruzdeva 1998; Mattissen 2003; Shiraishi 2006) as well as briefly consider Burmese (Okell 1969).

#### 3.3.1 *Nivkh*

This isolate language was briefly considered above in Section 2. As Shiraishi (2006) shows, in Nivkh certain phonological processes across word boundaries (involving changes in continuancy, aspiration, and voicing) are permitted only in certain syntactic configurations; in other words, reference to morphosyntax “outside” the target word is crucial.

#### 3.3.2 *Austronesian languages*

We will mostly discount the various “nasal substitution” processes in Austronesian (see Blust (2004) for a very complete overview): they are essentially very similar to the the Bantu case discussed above.

One language, however, stands aside in this context. In Nias, mutation is both triggered by certain lexical items in an idiosyncratic manner (à la Celtic and Romance), as in (14), and used in certain morphosyntactic contexts, notably to mark absolutive case (15). All Nias examples are from Brown (2001), with an orthography modified to reflect the IPA more closely.

- (14) a. *foʔomo*  
           spouse  
           ‘spouse’
- b. *i-be*           *xɣ*   *voʔomo-nia nuxa s-oyo*  
           3SG.RLS-give PREP spouse-3SG   cloth REL-be.red  
           ‘She gave red cloth to her husband’
- (15) a. *bavi*  
           pig  
           ‘pig’
- b. *la-bunu*   *bavi*  
           3PL.RLS-kill pig.ABS  
           ‘They killed a pig’

Brown (2001) interprets the latter type of mutation as induced by a case morpheme or clitic attaching to whole phrases (cf. the idea of clitics as the “morphology of phrases” in Anderson 2005). Nias mutation is probably the case most similar to the Celtic initial consonant mutation processes in terms of triggering.

### 3.3.3 *Burmese*

In Burmese (Okell 1969), causative verbs are formed by aspirating initial stops and devoicing initial sonorants:

- (16) a. *lu?*  
           be.free  
           ‘be free’  
       b. *lu?*  
           CAUS:be.free  
           ‘to free’

Initial [j] also changes to [ʃ]; otherwise, it looks like a rather straightforward addition of a [+spread glottis] feature.

## 3.4 *Australia*

The non-Pama-Nyungan language Iwaidja (Pym and Larrimore 1979; Evans 1998) presents a case of root-initial alternations similar to those found in Atlantic, Bantu and Austronesian. In the majority of cases the alternations are caused by overt prefixes (though with no identifiable relation to their surface phonology), but in a very few cases the locus of alternation becomes word-initial. Table 1 on the facing page (from Evans (1998), with a modified orthography) shows the paradigm of the intransitive verb *ɲaɖbuni* ‘fall’. The morphophonological alternation is between [k] and [g] / [ŋ]: the distribution between [g] and [ŋ] is irrelevant here.

However, as with the Atlantic, Bantu, and Austronesian cases referred to above, initial consonant mutation in Iwaidja can in no sense be said to target word-initial consonants specifically. It is entirely dependent on the identity of the preceding suffix, which Evans (1998) formalizes through an abstract *K* morphophoneme embedded in the suffixes’ lexical representation.

Table 1. Mutation in an Iwaidja intransitive verb

Person	Singular	Plural
1	ŋa-ŋaɖbuni	ad-kaɖbuni ŋad-kaɖbuni
2	aŋ-ŋaɖbuni	gud-gaɖbuni
3	kaɖbuni	a-ŋaɖbuni

### 3.5 Americas

There are at least four areas in the Americas where initial consonant mutation-like phenomena are attested: Numic languages (Uto-Aztecan), Mixe-Zoque, Mundurukú and Curuayá (belonging to the Tupi family), and various Macro-Jê languages.<sup>5</sup>

In the Numic languages, such as Comanche (Armagost 1989), Southern Paiute (Sapir 1930), and Chemehuevi (Press 1980), certain prefixes cause root-initial alternations not obviously related to their surface phonology, as the Comanche examples in (17) (Armagost 1989) show.

- (17) a. *puni*  
          ‘to see’  
      b. *waci<sup>h</sup>puni*  
          ‘to spy on’  
      c. *naβuni*  
          ‘to see oneself’

However, these changes can only be triggered when a morpheme is present to the left of the target, and thus it seems that the alternation site is only word-initial precisely when no alternation happens.

The Tupi languages Mundurukú and Curuayá (Picanço 2005) present a case very similar to Nivkh: the alternation is phonologically driven, but blocked in certain morphosyntactic domains. Thus, in Mundurukú the segment [d] undergoes devoicing to [t] following noncontinuants (both nasal and oral), as (18) demonstrates in an inalienable possession construction.

- (18) a. *dápsém toj*  
          deer      blood  
          ‘deer’s blood’

- b. *tawé doj*  
 monkey blood  
 ‘monkey’s blood’

However, this phonological process fails to happen in certain other morphosyntactic contexts: thus, for example mutation never happens after the alienable possessor prefix *-e-*.

In Zoque (Wonderly 1951; Akinlabi 1996) the 3SG possessor prefix is normally realized as palatalization of the first consonant. However, as Wonderly (1951) points out, the same effect is in evidence when a consonant is concatenated with a surface [j] (e. g. in compounding), and thus the “mutation” is in effect a surface-phonological process.

- (19) a. i. *faha*  
 belt  
 ‘belt’  
 ii. *ʃʰaha*  
 3SG.POSS:belt  
 ‘his / her belt’  
 b. i. *poj tsukum*  
 run go.out  
 ii. *potʃʰukum*  
 run;go.out  
 ‘run out’

A number of other South American languages (e. g. those belonging to the Macro-Jê family) use various methods of marking head-dependent adjacency (Rodrigues 2006). The exponence of this category varies widely, but in some languages it does include what looks like word-initial alternation (e. g. in Timbirá; Salanova 2004); for lack of space and data available to me, I do not concentrate on these cases further.

#### 4 The phonology of initial consonant mutations

The phonological exponence of mutation has attracted much theoretical interest. Within classical generative phonology, there were several rule-based accounts, concentrating on the Celtic languages (cf. Ó Siadhail and Wigger 1975 for Irish, and Rogers 1972 for Scottish); much attention was also paid to

Celtic initial consonant mutation phenomena within Dependency Phonology (Ó Dochartaigh 1978; Ewen 1982). With the introduction of autosegmental approaches, many more initial consonant mutation phenomena were considered, usually within a wider context of morphologically conditioned alternations (cf. Lieber (1987), among others, for a wider survey including Welsh, Fula and Mende data; Swingle (1993) for Irish; Wolf (2007) for Breton). In this section I will present a brief review of some issues around the phonological exponence of mutation.

The general idea of the autosegmental approach is that initial consonant mutation is caused by a feature (or bundle of features) which are otherwise floating being attached to the left edge of a morpheme and inducing changes in the featural make-up of its segments. In the simplest case, this predicts that initial consonant mutation involves a consistent change in one or several feature values in all segments which bear a value for that feature. One such case is presented by Nivkh (Table 2).

Table 2. ICM in Nivkh

Type	Consonants									
Non-mutated	p <sup>h</sup>	p	t <sup>h</sup>	t	c <sup>h</sup>	c	k <sup>h</sup>	k	q <sup>h</sup>	q
Mutated	f	v	r̥	r	s	z	x	ɣ	ʁ	ʁ̥

All Nivkh consonants with a [continuant] counterpart are involved in the initial consonant mutation process. Segments for which [cont] specification is redundant (namely all sonorants) are specified as [+cont] and thus cannot be affected by the prefixation of a [+cont] floating feature.

Even this relatively well-behaved system, however, needs a few remarks. The segment [r] does not behave like a sonorant, but rather as a fricative, in that it has a contrastive specification for [spread glottis] (for further arguments to this effect see Shiraishi 2006: 27).<sup>6</sup> Moreover, the coronal spirants [s] and [z] pattern with the palatal stops, rather than with the coronals.<sup>7</sup> The importance of facts such as these lies in demonstrating the importance of nontrivial featural specification (i. e. one based on the system of contrasts in the language rather than phonetic substance; cf. Drescher, Piggott and Rice 1994).<sup>8</sup> This problem is quite general, and not specifically related to initial consonant mutation, but we will see that this issue is a constant presence in other initial consonant mutation systems too.

Generally, initial consonant mutation and initial consonant mutation-like systems are “well-behaved” in this respect, in that the featural changes can to a large extent be captured by adding a feature. Consider the initial mutation system of Fula in Table 3 (Arnott 1970; Paradis 1992; Breedveld 1995; Koval’ 2000).

*Table 3.* ICM in Fula

Grade	Consonants											
Continuant	w	b	r	d	j	ʔ/w/j	f	t	s	h	ʃ	ʄ
Plosive		b	d	d	ɟ	g	p	t	c	k	ʃ	ʄ
Prenasalized	mb	mb	nd	nd	ɲɟ	ŋg	p	t	c	k	ʃ	ʄ

The names of the “grades” should be taken not as a literal description of the segments, but as labels referring to constellations of morphological contexts. Fula exemplifies a system where the segment appearing in one grade (mostly) allows predicting what segments appear in the others: this is why the “continuant” grade is normally considered to be underlying (e. g. by Breedveld 1995 and Paradis 1992). In an autosegmental account (cf. Lieber 1987), the “plosive” grade can be attained by prefixing a [–cont] feature and the “prenasalized” grade by whatever feature is responsible for this type of segment; the output will further need to be repaired to get rid of disallowed segments (e. g. prenasalized voiceless stops). However, a problem lurks with initial [w], [j], and [ʔ] in the continuant grade: each of these is ambiguous. It seems that some special marking is unavoidable: either morphological (i. e. different phonological changes in different morphological classes) or phonological (i. e. absolute neutralization; cf. Anderson 1976). Both of these are problematic.<sup>9</sup>

The final example comes from the Scottish Gaelic of Lewis (Borgstrøm 1940; Ladefoged et al. 1998). This variety presents a system that is largely typical of Scottish dialects in general. Table 4 on the next page presents it in a slightly simplified way (ignoring palatalization in obstruents and [m]); for a more general overview of phonological problems related to Celtic mutations, see Green (2006, 2007).

In this system, one problem is a chain shift: the fricative [f] deletes, but the stop [p<sup>h</sup>] spirantizes to [f] without deleting (cf. Wolf 2007 for one autosegmental approach to chain shifts within parallel Optimality Theory).<sup>10</sup>

Table 4. Mutation in the Scottish Gaelic of Lewis (simplified)

Grade	Consonants													
Unmutated	p <sup>h</sup>	t <sup>h</sup>	k <sup>h</sup>	p	t	k	f	s	m	n <sup>ʷ</sup>	n <sup>j</sup>	l <sup>ʷ</sup>	l <sup>j</sup>	r <sup>ʷ</sup>
Mutated	f	h	x	v	ɣ	ɣ	∅	h	ṽ	n	n	l <sup>ʷ</sup>	l	r

Moreover, the deletion of [f] is a problem for an autosegmental approach in itself: how can *adding* a feature lead to *deleting* an entire segment? (See Bye and Svenonius (2009) for one possible answer.) Secondly, the mutation of obstruents (and [m], which patterns with obstruents in some other respects in this language) involves some sort of continuancy mutation: how can it be reconciled with changes involving velarization or palatalization of the sonorants? (This is less of a problem with approaches such as that of Ó Dochartaigh (1978) for similar phenomena in Irish, where the formal phonology directly leverages “more/less vocal tract opening”.) Finally, this system also presents problems for straightforward phonetically-based features. Thus, if velarization and palatalization have uniform featural representations and mutation involves the prefixation of a single feature (bundle of features), it remains unclear why the relationship between mutated and non-mutated coronal nasals, laterals, and rhotics is so asymmetrical. Another similar problem is presented by the mutation of coronal obstruents: the addition of a continuancy feature to [d<sup>j</sup>] might be expected to yield [ð<sup>j</sup>]. That this does not happen could be taken as evidence for a highly ranked constraint against [ð<sup>j</sup>]; however, this segment functions as the palatalized correspondent of [r] in this dialect. This is not a problem, of course, if surface [ð<sup>j</sup>] is featurally specified as a sonorant.<sup>11</sup>

While very few problems that initial consonant mutation phenomena present to phonological theory are unique, it would seem that their importance might have been underappreciated, in light of the fact that initial consonant mutation phenomena are relatively rare and thus unknown to the non-specialist. At the same time initial consonant mutations present very clearly some of the issues that an autosegmental approach has to deal with, since no other solution within orthodox phonological theory seems to be available.

In the above discussion of autosegments, we have not touched upon the question of where they come from in the grammar. It is to triggering mutation that we turn in the next section.



## 5 Triggering initial consonant mutation

In this section I consider the nature of various contexts where initial consonant mutation is triggered cross-linguistically. I start with the simplest case, namely initial consonant mutation associated with specific lexical items, and then consider morphology and syntax as possible triggers for mutation.

### 5.1 Lexical triggers

Probably the most straightforward type of triggers is what I call “lexical” triggers. In this case initial consonant mutation is conditioned by the very presence of a specific lexical item (a word or non-null morpheme). Such triggers are attested in the majority of languages with initial consonant mutation or ICM-like phenomena: all Celtic languages, dialects of Italy,<sup>12</sup> some Mande and most Atlantic languages, the majority of Bantu and Austronesian languages, Iwaidja, Nias, and the Numic languages can be named here. Nivkh and Mundurukú/Curuayá (as well as the Jê languages, as far as I can tell) apparently stand out in this respect.

From the standpoint of theoretical phonology, such triggering presents very little problem. Assuming that the features are right (though as I have tried to show in Section 4 this is no easy task), we simply postulate the requisite feature bundle at the right edge of the trigger.<sup>13</sup> There are, however, several problems with this approach.

#### 5.1.1 Locality

A necessary condition for “autosegmental” triggering is adjacency (at some tier): the autosegment (“morphophoneme”) docks to the nearest available target (in the case of initial consonant mutation, to its right). Thus, we expect lexical triggers and targets to be adjacent. This, however, is not always the case. Thus, in Irish the numeral *dhá* ‘two’ and borrowed expletives (such as *fuckin*’) are “transparent” to mutations (Green 2007: 97–99).

- (20) a. *ár*            *[dʲ]each*  
           POSS.1PL house  
           ‘our house’  
       b. *dhá* *[h]each*  
           two house  
           ‘two houses’

- c. *ár dhá [dʲ]each*  
 POSS.1PL two house  
 ‘our two houses’

In Breton, the word *holl* ‘all’ shows identical behaviour (Stump 1988): like Irish *dhá*, it causes a mutation when not preceded by a trigger, but when a possessive pronoun is present, it is the mutation required by the pronoun that surfaces. In Italian, parenthetical insertions can be transparent to *rad-doppiamento* (Loporcaro 1996). It remains unclear how exactly such lexical triggering at a distance can be explained (Wolf 2007 sketches one such account, but does not flesh it out).

### 5.1.2 *Restricted triggers*

This subsumes cases where the mere presence of the trigger is not a sufficient condition for mutation. Ball and Müller (1992: 6–7) distinguish between *categorical* and *restricted* lexical triggers. In the former case, the same lexical item may trigger a mutation or fail to do so depending on its own category (thus, Irish *idir* causes mutation when it is a conjunction and does not cause mutation when it is the preposition ‘between’); in the former, triggering is restricted by conditions on the target (thus, in Welsh the definite article only causes mutation on a following feminine singular word). Of course, accidental homophony can be proposed (i. e. two separate lexical items: *idir*[L] ‘and’ and *idir* ‘between’, where [L] is whatever triggers the mutation). For a full account of such restricted triggers, however, a discussion of morphology is unavoidable.

## 5.2 Morphological triggers

In this section I argue that an account which takes mutation-inducing autosegments or “morphophonemes” as exponents of morphological categories (along the lines of Wolf 2007) is not empirically and conceptually adequate for most cases of initial consonant mutation considered in this paper.

The majority of “morphological” initial consonant mutation triggering cases involve an explicit morpheme along with the segmental alternation, normally at the same edge as the alternation site (i. e. mutation is triggered by a prefix). This is the situation in Romance, most Bantu, Austronesian, and At-

lantic languages, Iwaidja, and many Mande languages. Under the classification proposed here, these are lexical triggers, since the autosegment is easily interpreted as being part of the prefix's lexical representation. In this section I will consider mutations which have been proposed to be the *sole* exponent of some grammeme, i. e. a subcase of *featural affixation* (Akinlabi 1996), itself a relatively rare phenomenon.

### 5.2.1 *Fula*

One such case is Fula. Recall that in Fula, alternations are word-initial (or root-initial: it is impossible to say which *prima facie*, since there are no prefixes in the language) but clearly related to grammemes normally expressed by suffixes. Most theoretical studies of Fula concentrate on the nominal system, where a class suffix is obligatorily present.<sup>14</sup>

- (21) a. *yim-re*  
           song-CL  
           ‘song’  
       b. *gim-e*  
           song-CL  
           ‘songs’

In this case the standard analysis (Paradis 1992; Breedveld 1995) is to argue that the class morphemes are actually circumfixes: thus, for Breedveld (1995) the exponent of class in (21b) is ?-...-e. While this is not impossible, such pre-root elements are otherwise quite unknown in Fula: there is no *independent* evidence for such prefixes, and they are only postulated from theoretical premises (namely that something must be triggering the initial consonant mutation phonology).

Koval' (1997) provides further evidence against this approach. She notes that in some nouns the singular and plural are identical save for the mutation grade. A case in point is *yiit-e* ‘fire’, plural *giit-e*. Normally the class suffixes also undergo various alternations (Churma 1988; Breedveld 1995), and in this particular case two suffixes belonging to distinct classes are accidentally homonymous. Koval' (1997) notes that in some dialects the plural form is *giit-ee-li*, with two class suffixes (otherwise an anomaly<sup>15</sup>). According to Koval' (1997), such forms arise because initial consonant mutation is not sufficient to distinguish the singular and plural forms; in other words, sin-

Table 5. Fula verb paradigm (fragment)

Person	Full subject		Enclitic subject	
	SG	PL	SG	PL
1	mi <b>yar</b> -ii	min <b>njar</b> -ii en <b>njar</b> -ii	<b>njar</b> -mi	— <b>njar</b> -ɗen
2	a <b>yar</b> -ii	on <b>njar</b> ii	<b>njar</b> -ɗaa	<b>njar</b> -ɗon
3	o <b>yar</b> -i	be <b>njar</b> -ii	—	—

gular *yiit-e* and plural *\*giit-e* are non-distinct for the purposes of morphology. This generalization cannot be expressed in terms of any theory postulating mutation-inducing phonological elements as part of the morpheme: the morphemes for the two classes are then by necessity distinct.

A similar argument applies for the verbal system. The basic rule for mutation is as follows:

In mutating verbs, the prenasalized grade of the initial appears (a) with a plural subject and (b) if the subject is an enclitic pronoun; else the initial appears as a continuant. [Koval' (2000): 170; my translation]

In general there is no subject-verb agreement in a Fula clause: the subject is only referred to once, either in a preverbal position (as a pronoun or full noun phrase) or cliticized to the verb (except the 3rd person and 1PL exclusive).<sup>16</sup> The “plural subject” rule applies regardless of subject type. Table 5 shows a fragment of a verbal paradigm (*yar*- ‘drink’).

If the prenasalization is due to some phonological material introduced in the morphology, then this material must be thought of as either forming a circumfix with the enclitic (e.g. 1SG *N*...-*mi*) or representing an agreement morpheme. The former case is open to the same criticism as above, while the latter has the additional disadvantage of necessitating the introduction of a morphosyntactic process otherwise unattested in the language, namely number agreement: note that where agreement does happen (inside the determiner phrase), it proceeds by class, not by number.<sup>17</sup>

Summing up the discussion of Fula, I propose that initial consonant mutation-inducing phonological elements are problematic from two points of view. First, it raises phonological issues, as pointed out in Section 4, since a phonological account necessitates absolute neutralization. Second, viewing the putative autosegments as parts of morphemes is problematic in that it pre-

supposes morphosyntactic phenomena otherwise unattested in the language (prefixation, number agreement between subject and verb).<sup>18</sup>

One alternative is to interpret the mutation process as reflecting distributional requirements on the selection of root allomorphs in certain morphosyntactic contexts (Carstairs-McCarthy 1987; Stump 1995). This is much less problematic from a grammatical point of view; the downside, as emphasized by Wolf (2007), is a missed generalization: the phonological regularity of the relations between allomorphs (as we have seen, in Fula these relations are quite regular) is relegated to an accidental similarity (yet cf. Booij 2002). If such an account is accepted for Fula, we must exclude it from the “core” of initial consonant mutation languages, since the mutation then specifically targets the *root*-initial consonant instead of the word-initial one.

### 5.2.2 *Welsh*

Another language for which a morphological account has been proposed is Welsh. Kibre (1997) argues that the so-called soft mutation is an exponent of a [FEM SG] morpheme within the determiner phrase (in Welsh, adjectives are mutated following a feminine singular noun or article (importantly, *all* adjectives in this position are mutated, e. g. if there is more than one dependent on a single noun), and feminine singular nouns are mutated following the article). This is, however, not an empirically correct generalization: prenominal adjectives are *ceteris paribus* not mutated, but they still agree in gender with their head (example adapted from Morgan 1952: 12):

- (22) *\*(l)lwm aelwyd*  
       poor.FEM hearth  
       ‘poor hearth’

In (22), the adjective *llwm* ‘poor’ is not mutated (i. e. it is not *lwm*, though this form *per se* is possible in other contexts: *i lwm ddyn* ‘to a poor person’), but still takes the feminine singular form *llom*. Thus the lack of mutation cannot be ascribed to a lack of agreement in prenominal position. This can be compared to the situation in Nias (Brown 2001), where mutation marks S arguments of monovalent verbs and P arguments of bivalent verbs, and can thus be construed as a mark of absolutive case. However, if the argument is fronted (normal word order in Nias is VOS), the mutation does not apply: probably further study is needed to determine whether this lack of mutation

is due to lack of case assignment in the preverbal position or some special feature of the mutation process. In Welsh, however, the evidence seems clear: any putative initial consonant mutation-inducing prefix cannot be a marker of [FEM SG] agreement.

Another morphological marker proposed by Kibre (1997) is a “non-topic” prefix which is attached to all constituents not occupying the immediately postverbal position. While this solution is formally impeccable, Kibre (1997) himself notes that this “non-topic” marker is somewhat unprecedented cross-linguistically, and, moreover, is not actually related to the information structure (i. e. actual topics can occupy the “non-topic” position and vice versa). He proposes that the marker is the product of grammaticalization of a morpheme which historically played a part in the semantics-syntax interface, but is now irrelevant in that respect. Thus, this lexical item is in fact no less *ad hoc* than the autosegmental “clitic” proposed by Lieber (1987) for Mende, which is simply inserted in a given syntactic configuration for no semantic reason.

Roberts (2005) proposes an analysis of Welsh which interprets some mutation as an exponent of Case; see below for brief discussion, and (Borsley, Tallerman and Willis 2007: chapter 7) for a detailed critique.

### 5.2.3 *Mende*

One language where a genuine morphological solution seems available is Mende. In this language the nasal present in other related languages has disappeared from the surface, but the mutation remains. Various accounts of Mende mutation have been proposed based on syntactic configurations having to do with c-command and branchingness (Rice and Cowper 1984; Conteh, Cowper and Rice 1985), case (Seidl 2001), agreement (Tateishi 1990), and prosodic boundaries (Cowper and Rice 1987; Tokizaki 2005). However, all these accounts presuppose a reversal of the historical direction of phonological changes: they view the so-called “strong” grade as underlying, and thus the elsewhere case. In fact the strong grade is historically postnasal, and thus conserved in very specific morphological environments (see Hyman (1973); Dwyer (1986) for the history of these environments, and Kastenholtz (1996); Vydrine (2004) for the phonological history). For lack of space I do not consider this question closer here: Vydrine (2004) hints at an account where the “strong” grade is derived and appears in a well-defined morphological environment.<sup>19</sup>

### 5.3 Syntax

Finally, we consider some cases where syntax is claimed to be directly involved in mutations: initial consonant mutation happens whenever a certain configuration of syntactic constituents is present. We have briefly discussed one such case in Mende, reinterpreting it as morphological.

Another example comes from the “direct object mutation” in Welsh (Ball and Müller 1992; Borsley, Tallerman and Willis 2007). In Welsh constituents following the first postverbal phrase undergo soft mutation (including objects in VSO clauses, whence the name). However, this type of mutation applies also to subjects (and does not apply to objects of impersonal verbs, which do not raise to subject position); the evidence is carefully discussed in Borsley, Tallerman and Willis (2007: ch. 7). An alternative to the case-based account by Roberts (2005) (cf. also Zwicky 1984) is the “XP-trigger hypothesis”, originally advanced by Borsley and Tallerman (1996):

XP triggers soft mutation on the initial consonant of the right-adjacent constituent which it c-commands.

If this is indeed the correct generalization, then it is not entirely clear how mutation can be triggered autosegmentally: a meaning-less morpheme inserted into a given syntactic configuration would be quite unprecedented (apart from the “clitic” that Lieber (1987) introduces for Mende).

Syntax is also involved in Welsh mutation in a different way. Disruptions of normal word order often cause mutation (Tallerman 1999): for example, all nouns which follow adjectives are mutated, irrespective of gender and number. Again, it does not seem obvious what (sub)segmental morpheme can produce such an effect.

Nivkh and Mundurukú present a different type of syntax-induced mutation (or perhaps mutation blocking): in these languages, no autosegment is required as the phonology of mutation patterns is entirely surface-based. However, mutation only happens in certain syntactic domains, and thus syntactic information is indispensable to the initial consonant mutation process. This raises all sorts of questions with respect to modularity and interfaces, in particular whether syntactic information (such as constituent structure outside the word) is available in phonology (cf. Hayes (1990) for one positive answer).

## 6 Typology

As I have tried to demonstrate above, initial consonant mutation, despite being quite rare cross-linguistically, present a great deal of variation. I now return to the question posed at the beginning of the paper: can we view initial consonant mutation as a unified phenomenon, and what are the relevant typological generalizations?

I propose that the first of these questions receives a positive answer in view of the apparent importance of the beginning of the word. Possibly underpinned by its importance in psycholinguistic respects (e. g. word recognition, cf. Marslen-Wilson and Zwitserlood 1989), the left edge of a word is commonly assumed to be special in one phonological sense or another (Beckman 1999; Smith 2002). In this connection it is remarkable that initial consonant mutation always involves exactly the left edge of the word, and only very rarely does it impinge on non-initial segments. Thus, for example, vowel-initial words are, to my knowledge, never affected by initial consonant mutation processes. There are also, as far as I know, no examples of an “anti-Chaha” pattern, where mutation is realized on the leftmost available consonant, which is not necessarily word-initial (Lieber 1987). In Chaha, morphophonological labialization is realized on the rightmost non-coronal consonant (there are no labialized coronals in the language): thus *dænæg* ‘he hit him’, but *q<sup>w</sup>ætær* ‘he killed him’, *sædæd* ‘he chased him’. Lieber (1987) considers this gap accidental; I propose, however putatively, that it is not, in that it shows that whenever something disrupts the beginning of a word, the first segment must always be included.<sup>20</sup>

With respect to initial consonant mutation typology, I propose a major distinction between *endocentric* and *exocentric* initial consonant mutation and ICM-like processes (a similar distinction is proposed by Ternes 1990). Endocentric alternations are those which can be described solely with reference to the word they are associated with (its phonology, make-up in terms of morphemes, lexical class, and morphosyntactic features). Thus, all alternations caused by prefixes (whether segmentally or autosegmentally) are endocentric. Fula (in the interpretation proposed in 5.2.1) is thus also a case of endocentric mutation, since the morphemic make-up and morphosyntactic features are sufficient to determine the mutation grade. Exocentric mutation, on the other hand, cannot be described without reference to some factors outside the word, such as the syntactic context (Nivkh, Mundurukú, Welsh) or the position of the word with respect to some other item (Nias, Welsh, Irish).



Furthermore, I propose that exocentric mutations form the “core” of the initial consonant mutation “space”. This is because endocentric mutations are, by definition, associated with morphosyntactic elements otherwise present in the language. This means that postulating relevant morphemes or morphological processes is quite straightforward, and thus the mutations are not special, given an adequate theory of morphophonology.

With exocentric mutations, on the other hand, such initial consonant mutation-triggering elements can be problematic from the point of view of the overall grammar, since their insertion cannot be likened to the insertion of “conventional” morphemes. Whether this necessitates introducing special morphological operations on whole words (cf. Hayes (1990); Green (2007) and Stewart (2004) specifically for Scottish Gaelic) is just one question that the rare phenomenon of initial consonant mutation poses to linguistic theory.

## 7 Conclusion

Lack of space has prevented discussion of other initial consonant mutation-related topics, such as the relationship between the properties of triggers and targets; trigger interaction; the interplay of initial consonant mutation and surface phonology (cf. Stump (1987) for Breton); the role of paradigmatic factors (cf. Shiraishi (2004) for Nivkh); the role of morphology (e. g. do mutations affect roots, stems or whole words, cf. Stewart 2004) etc. However, I hope to have demonstrated some of the importance of initial consonant mutations *as rara*.

First, if the interpretation of exocentric mutations as the “core” type is accepted, they are in fact quite rare: it is only the Celtic mutations (though they present several distinct types), Nias, Nivkh, and Mundurukú that undoubtedly present a case of endocentric initial consonant mutation (depending on the interpretation, the dialects of Italy and Fula may also be part of this group).

Second, while endocentric initial consonant mutation is a more or less straightforward subcase of morphologically induced phonological alternations and does not seem to raise theoretical questions significantly different from other phonological phenomena, exocentric initial consonant mutations are an altogether different proposition.

Quite apart from the phonological difficulties, they pose interesting questions to an additive theory of grammar which derives phonological alternations solely from the juxtaposition of (quasi-)phonological elements (cf.

Booij (2002) for a different view). In that sense, they do indeed form a special – albeit very small – class of phenomena. Only further study will show whether initial consonant mutations are truly a *sui generis* phenomenon, necessitating amendments to our view of grammar, or simply the outcome of an unusual confluence of otherwise unexceptional factors.

## Abbreviations

1, 2, 3 = 1st, 2nd, 3rd person; ABS = absolutive case; ACC = accusative case; ACT = active voice; CAUS = causative; CL(1, 2...) = class (1, 2...); DIR = direct case; FEM = feminine gender; FOC = focus marker; ICM = initial consonant mutation; INF = infinitive; LOC = locative; OBJ = object; OBL = oblique case; PERF = perfect tense; PL = plural; POSS = possessive; PREP = preposition; PRS = present tense; PST = past tense; REFL = reflexive pronoun; REL = relative complementizer; RLS = realis mood; SG = singular; VOS = verb–object–subject

## Acknowledgments

Some of the material presented in this paper was included in my presentation at the *Rara & Rarissima* conference. I thank the audience in Leipzig for their valuable input, in particular Larry Hyman and Peter Bakker. I would also like to thank Vladimir Plungian, who was my supervisor during the project that this paper grew out of. Thanks are also due to Peter Arkadiev, Patrik Bye, S. J. Hannahs, Sergei Knyazev, Bruce Morén-Duolljá, Elena Parina, Dmitri Sichinava, Jochen Trommer, and Valentin Vydrine. Special thanks are due to the editors of the volume. It is needless to mention that all errors and shortcomings are, of course, entirely mine.

## Notes

1. That does not mean that such cases are totally uninteresting from an initial consonant mutation perspective: at least in the Celtic languages, mutations are ultimately the outcome of the grammaticalization of essentially the same phenomenon.
2. Though some cases of such interaction do exist: for example, in Indonesian “nasal substitution” takes place between a prefix and a root but not between two prefixes (Blust 2004: 123).
3. With respect to languages with mutation, Nivkh is a particularly instructive example: what Shiraishi (2006) interprets as syntactic domains, Mattissen (2003) at length argues to be “words”.

4. Though Standard Italian as spoken in the north of Italy lacks this feature (De Mauro 1976).
5. Here I discount morpheme-initial phenomena that are never or only rarely word-initial, such as the Athabaskan *d*-effect.
6. Some other languages with initial consonant mutation-like phenomena where the (phonetically voiced) rhotic patterns with the voiced fricatives are Fula, Basari, Konyagi, Venda, and Chemehuevi, while in Tswana, Seereer, and Bedik they pattern with *voiceless* fricatives.
7. Other languages where coronal spirants pattern with palatals or postalveolars in initial consonant mutation-like phenomena are Fula (and other Atlantic languages), Javanese (and other Austronesian languages), and Nias.
8. Interestingly, the problem of featural specification of [r] with special reference to Nivkh was already raised by Trubetzkoy (1939).
9. Of course, it is entirely possible that closer (instrumental) analysis of Fula phonetics may reveal a difference between the realization of the ambiguous segments belonging to different mutation series, in which case the objection falls. I am not, however, aware of any such study.
10. The other Celtic languages: Irish (Christian Brothers 1999), Welsh (Ball and Müller 1992), Cornish (Lewis 1946) and Breton (Kervella 1946; Stephens 1993) present even more involved chain-shifting systems in their initial consonant mutation.
11. Other languages (without initial consonant mutation) where [ð] functions as a sonorant are Woods Cree (Ballard and Starks 2005) and Osage (Quintero 2004).
12. Interestingly, it seems that the existence of *raddoppiamento* triggered by surface phonological factors (namely stress) implies the presence of lexically triggered *raddoppiamento*, but not vice versa (cf. Loporcaro 1996).
13. In a less restrictive theory of (morpho)phonology, even the requirement for featural coherence is not necessary: the mutation can be triggered by fully abstract diacritic elements (sometimes called “morphophonemes”). The foremost exponent of this idea is Hamp (1951) with respect to Celtic; Pym and Larrimore (1979); Evans (1998) take a similar approach to Iwaidja.
14. Not all varieties of Fula demonstrate initial consonant mutation in verbs.
15. Except those dialects where a uniform plural suffix is being developed (Koval’ 2000).
16. The distribution of preposed vs. enclitic subjects is dependent on tense-aspect-modality features and information structure.
17. A note on terminology: I follow an Africanist tradition in distinguishing *gender* as a pair of *classes*, each of which is interpreted as singular or plural within each particular gender. It is classes that are morphologically marked.
18. Fula is also problematic for realizational approaches where morphophonological phenomena arise from the requirement to make morphologically dissimilar forms phonologically dissimilar (cf. Kurisu 2001): since the relevant morphological categories are spelled out by explicit morphemes, lack of mutation fails to violate the realization requirement (Wolf (2007) also points this out for suffix-induced morphophonology in Nilotic languages).
19. This account was fleshed out in more detail in Iosad (2008).
20. I know of two possible counterexamples. One is Terena (Akinlabi 1996), where [nasal] spreads rightwards to both consonants and vowels until a stop is encountered; if the stop

is word-initial, the process is reminiscent of initial consonant mutation. However, such spreading clearly does not target word-initial consonants specifically and is thus not an initial consonant mutation by our definition. Another is from Jaxaaw Seereer-Siin, where continuancy can occasionally spread not just to the initial segment, but also to the second consonant of a root: *sox* 'to squeeze', *coq* 'a squeeze' (Fal 1980: 114). None of these cases is like Chaha, however, in that the "word-internal" alternation is always cued at the triggering (left) edge, whereas in Chaha the alternation site can be fully disassociated from the triggering edge.

## References

- Akinlabi, Akinbiyi  
1996        Featural affixation. *Journal of Linguistics* 32: 239–289.
- Anderson, Stephen R.  
1976        On the description of consonant gradation in Fula. *Studies in African linguistics* 7.1: 93–136.
- Anderson, Stephen R.  
2005        *Aspects of the theory of clitics*. Oxford: Oxford University Press.
- Armagost, James L.  
1989        Comanche consonant mutation: initial association or feature spread? *Kansas Working Papers in Linguistics* 14.2: 1–19.
- Arnott, David W.  
1970        *The nominal and verbal systems of Fula*. Oxford: Clarendon.
- Ball, Martin J., and James Fife (eds.)  
1993        *The Celtic languages*. London/New York: Routledge.
- Ball, Martin J., and Nicole Müller  
1992        *Mutation in Welsh*. London/New York: Routledge.
- Ballard, Elaine, and Donna Starks  
2005        Liquids: laterals, rhotics and much more? In *Proceedings of the 2004 Conference of the Australian Linguistics Society*, Ilana Mushin (ed.).  
http://hdl.handle.net/2123/102
- Beckman, Jill N.  
1999        *Positional faithfulness*. Doctoral dissertation, University of Massachusetts, Amherst.
- Blust, Robert R.  
2004        Austronesian nasal substitution: a survey. *Oceanic Linguistics* 43.1: 73–148.
- Booij, Geert  
2002        The balance between storage and computation in phonology. In *Storage and computation in the language faculty*, Sieb Nooteboom, Fred Weerman and Frank Wijnen (eds.), 115–138. Dordrecht: Kluwer.
- Borgstrøm, Carl Hjalmar  
1940        *The dialects of the Outer Hebrides*, vol. 1, A linguistic survey of the Gaelic dialects of Scotland. Oslo: Norwegian Universities Press. Norsk Tidsskrift for Sprogvidenskap, suppl. bind I.

- Borsley, Robert D., and Maggie Tallerman  
1996 Phrases and soft mutation in Welsh. *Journal of Celtic Linguistics* 5: 1–49.
- Borsley, Robert D., Maggie Tallerman, and David Willis  
2007 *The syntax of Welsh*. Oxford: Oxford University Press.
- Breedveld, Johanna Odilia  
1995 *Form and meaning in Fulfulde: A morphophonological study of Maasinan-koore*. Leiden: Research School CNWS.
- Brown, Lea  
2001 *A grammar of Nias Selatan*. Doctoral dissertation, University of Sydney.
- Brown, Lea  
2005 Nias. In *The Austronesian languages of Asia and Madagascar*, K. Alexander Adelaar and Nikolaus P. Himmelmann (eds.), 562–587. London/New York: Routledge.
- Bullock, Barbara  
2001 Consonant gemination in Neapolitan. In *Phonological theory and the dialects of Italy*, Lori Repetti (ed.), 45–58. Amsterdam: Benjamins.
- Bye, Patrik and Peter Svenonius  
2009 Extended exponence and non-concatenative morphology. Manuscript, University of Tromsø.
- Carstairs-McCarthy, Andrew  
1987 *Allomorphy in inflexion*. London: Croom Helm.
- Christian Brothers  
1999 *New Irish grammar by the Christian Brothers*. Dublin: CJ Fallon.
- Churma, Donald G.  
1988 Consonant gradation in Fula suffixes: the ugly truth. *Studies in African linguistics* 19.1. 35–74.
- Conteh, Patrick, Elizabeth Cowper, and Keren Rice  
1985 The environment for consonant mutation in Mende. In *Current issues in African linguistics*, Gerrit Dimmendaal (ed.), vol. 3, 107–116. Dordrecht: Foris.
- Cowper, Elizabeth and Keren Rice  
1987 Are morphosyntactic rules necessary? *Phonology Yearbook* 4: 185–194.
- De Mauro, Tullio  
1976 *Storia linguistica dell'Italia unita*. Bari: Laterza.
- D'Imperio, Mariapaola and Sam Rosenthal  
1999 Phonetics and phonology of main stress in Italian. *Phonology* 16: 1–28.
- Doke, Clement Martyn  
1954 *The Southern Bantu languages*. London/New York: Oxford University Press.
- Dresher, Bezalel Elan, Glyne Piggott, and Keren Rice  
1994 Contrast in phonology: overview. *Toronto Working Papers in Linguistics* 14: iii–xvii. Mande. In *Current approaches to African linguistics*, Gerrit J. Dimmendaal (ed.), vol. 3, 149–170. Dordrecht: Foris.
- Evans, Nicholas  
1998 Iwaidja mutation and its origins. In *Case, typology and grammar*, Anna Siewerska and Jae Jung Song (eds.), 115–151. Amsterdam: Benjamins.

- Ewen, Colin J.  
1982 The phonological representation of the Welsh mutations. In *Language form and linguistic variation*, J. Anderson (ed.), 75–95. Amsterdam: Benjamins.
- Fal, Arame  
1980 *Les nominaux en Seereer-Siin: parler de Jaxaaw*. Dakar: Les nouvelles éditions africaines.
- Ferry, Marie-Paule  
1968 L'alternance consonantique en bedik. *Journal of West African Languages* 5.2: 91–96.
- Giannelli, Luciano and Thomas D. Cravens  
1996 Consonantal weakening. In *The dialects of Italy* Martin Maiden and Mair Parry (eds.), 32–40. London / New York: Routledge.
- Green, Anthony Dubach  
2006 The independence of phonology and morphology: The Celtic mutations. *Lingua* 116 (11): 1946–1985.
- Green, Anthony Dubach  
2007 *Phonology limited*. Potsdam: Universitätsverlag.
- Gruzdeva, Ekaterina  
1998 *Nivkh*. München: LINCOM Europa.
- Hamp, Eric P.  
1951 Morphophonemes of the Keltic mutations. *Language* 27.3: 230–247.
- Hayes, Bruce  
1990 Precompiled phrasal phonology. In *The phonology-syntax connection*, Sharon Inkelas and Draga Zec (eds.), 85–108. Chicago: University of Chicago Press.
- Hyman, Larry M.  
1973 Notes on the history of Southwestern Mande. *Studies in African linguistics* 4: 183–196.
- Iosad, Pavel  
2008 Initial consonant mutation and information flow in Mende. Presentation at Old World Conference in Phonology 5, Université de Toulouse–Le Mirail.
- Kastenholz, Raimund  
1996 *Sprachgeschichte im West-Mande*. Köln: Köppe.
- Kervella, Frañsez  
1946 *Yezhadur bras ar brezhoneg* [A Comprehensive Grammar of Breton] La Baule: Skridou Breizh.
- Kibre, Nicholas J.  
1997 *A model of mutation in Welsh*. Bloomington: Indiana University Linguistics Club.
- Koval', Antonina Ivanovna  
1997 Imennyje kategorii v pular-ful'ful'de. [Nominal categories in Pular-Fulfulde] In *Osnovy afrikanskogo jazykoznaniya: Imennyje kategorii* [Introduction to African linguistics: Nominal categories], V. A. Vinogradov (ed.), 92–220. Moscow: Aspekt Press.

- Koval', Antonina Ivanovna  
2000 Morfemika pular-ful'ful'de [Pular-Fulfulde morphemics]. In *Osnovy afrikan-skogo jazykoznanija: Morfemika. Morfonologija* [Introduction to African linguistics. Morphemics. Morphology], V. A. Vinogradov (ed.), 103–254. Moscow: Vostočnaja literatura.
- Kurisu, Kazutaka  
2001 *The phonology of morpheme realization*. Doctoral dissertation, University of California, Santa Cruz.
- Ladefoged, Peter, Jenny Ladefoged, Alice Turk, Kevin Hind and St. John Skilton  
1998 Phonetic structures of Scottish Gaelic. *Journal of the International Phonetic Association* 28: 1–41.
- Lewis, Henry  
1946 *Llawlyfr Cernyweg Canol* [A Handbook of Middle Cornish] Caerdydd: Gwasg Prifysgol Cymru.
- Lieber, Rochelle  
1987 *An integrated theory of autosegmental processes*. Albany: State University of New York Press.
- Loporcaro, Michele  
1996 Lengthening and *raddoppiamento*. In *The dialects of Italy*, Martin Maiden and Mair Parry (eds.), 41–51. London / New York: Routledge.
- Loporcaro, Michele  
1997 *L'origine del raddoppiamento fonosintattico: saggio di fonologia diacronica romanza*. Torino: Rosenberg & Sellier.
- Marslen-Wilson, William and Pienie Zwitserlood  
1989 Accessing spoken words: the importance of word onsets. *Journal of Experimental Psychology, Human Perception and Performance* 15.3: 576–585.
- Mattissen, Johanna  
2003 *Dependent-head synthesis in Nivkh: A contribution to a typology of polysynthesis*. Amsterdam: Benjamins.
- McLaughlin, Fiona  
1994 Consonant mutation in Seereer-Siin. *Studies in African linguistics* 23: 279–313.
- McLaughlin, Fiona  
2000 Consonant mutation and reduplication in Seereer-Siin. *Phonology* 17: 1–30.
- Morgan, Thomas John  
1952 *Y treigladau a'u cystrawen* [The mutations and their syntax] Caerdydd: Gwasg Prifysgol Cymru.
- Ní Chiosáin, Máire  
1991 *Topics in the phonology of Irish*. Doctoral dissertation, University of Massachusetts, Amherst.
- Ó Dochartaigh, Cathair  
1978 Lenition and dependency phonology. *Éigse* 17: 457–494.
- Ó Siadhail, Mícheál and Arndt Wigger  
1975 *Córas fuaimeanna na Gaeilge* [The sound pattern of Irish] Baile Átha Cliath: Institiúid Ard-Léinn Bhaile Átha Cliath.

- Oftedal, Magne  
1985 *Lenition in Celtic and in Insular Spanish*. Oslo: Universitetsforlaget.
- Okell, John  
1969 *A reference grammar of colloquial Burmese*. London: Oxford University Press.
- Paradis, Carole  
1992 *Lexical phonology and morphology: the nominal classes in Fula*. New York / London: Garland.
- Picanço, Gessiane  
2005 *Mundurukú: Phonetics, phonology, synchrony, diachrony*. Doctoral dissertation, University of British Columbia.
- Press, Margaret  
1980 *Chemehuevi: a grammar and lexicon*. Berkeley / Los Angeles: University of California Press.
- Pym, Noreen and Bonnie Larrimore  
1979 *Papers on Iwaidja phonology and grammar*, A-2. Darwin: Summer Institute of Linguistics, Australian Aborigines Branch.
- Quintero, Carolyn  
2004 *Osage grammar*. Lincoln / London: University of Nebraska Press.
- Rice, Keren and Elizabeth Cowper  
1984 Consonant mutation and autosegmental morphology. In *Proceedings of CLS 20*, Joseph Drogo, Veena Mishra and David Testen (eds.), 309–320. Chicago: Chicago University Press.
- Roberts, Ian  
2005 *Principles and parameters in a VSO language: A case study in Welsh*. Oxford: Oxford University Press.
- Rodrigues, Aryon D  
2006 Macro-Jê. In *The Amazonian languages*, R. M. W. Dixon and Alexandra Aikhenvald (eds.), 165–206. Cambridge: Cambridge University Press.
- Rogers, Henry  
1972 The initial mutations in Modern Scots Gaelic. *Studia Celtica* 7: 63–85.
- Salanova, Andrés Pablo  
2004 Initial truncation in Mëbengokre. Manuscript. Massachusetts Institute of Technology, Boston.
- Sapir, Edward  
1930 The Southern Paiute language (part I): Southern Paiute, a Shoshonean language. *Proceedings of the American Academy of Arts and Sciences* 65: 1–296.
- Seidl, Amanda  
2001 *Minimal indirect reference: A theory of the syntax-phonology interface*. London / New York: Routledge.
- Shiraishi, Hidetoshi  
2004 Base-identity and the noun-verb asymmetry in Nivkh. In *On the boundaries between phonetics and phonology*, Dicky Gilbers, Maartje Schreuder and Nienke Knevel (eds.), 159–182. Groningen: University of Groningen.
- Shiraishi, Hidetoshi  
2006 *Topics in Nivkh phonology*. Doctoral dissertation, University of Groningen.



- Smith, Jennifer L.  
2002 *Phonological augmentation in prominent positions*. Doctoral Dissertation, University of Massachusetts, Amherst.
- Stephens, Janig  
1993 Breton. In *The Celtic languages*, Martin J. Ball and James Fife (eds.), 349–409. London / New York: Routledge.
- Stewart, Thomas W.  
2004 *Mutation as morphology: Bases, stems and shapes in Scottish Gaelic*. Doctoral dissertation, Ohio State University.
- Storch, Anne  
1995 Die Anlautpermutation in den westatlantischen Sprachen. *Frankfurter afrikanistische Blätter* 2.
- Stump, Gregory T.  
1987 On incomplete mutations in Breton. In *A Festschrift for Ilse Lehiste*, Brian Joseph and Arnold Zwicky (eds.), 1–10. (= Ohio State University Working Papers in Linguistics; 35).
- Stump, Gregory T.  
1988 Nonlocal spirantization in Breton. *Journal of Linguistics* 24: 457–481.
- Stump, Gregory T.  
1995 Stem formation, stem indexing and stem choice. Manuscript. Lexington: University of Kentucky.
- Swingle, Kari  
1993 The Irish and other mutations. In *Proceedings of West Coast Conference on Formal Linguistics 11*, Jonathan Mead (ed.), 451–466. Stanford: Center for the Study of Language and Information.
- Tallerman, Maggie  
1999 Welsh soft mutation and marked word order. In *Functionalism and formalism in linguistics*, vol. 2, Michael Darnell, Edith Moravcsik, Frederick Newmeyer, Michael Noonan and Kathleen Wheatley (eds.), 277–294. Amsterdam: Benjamins.
- Tateishi, Koichi  
1990 A morphological analysis of Mende consonant mutation. *Current approaches to African linguistics* 7: 99–110.
- Ternes, Elmar  
1990 Initial mutations in Celtic and West African languages: synchrony and diachrony. *Afrika und Übersee* 73: 3–17.
- Thomas, Peter Wynn  
1996 *Gramadeg y Gymraeg* [A Welsh Grammar]. Caerdydd: Gwasg Prifysgol Cymru.
- Tokizaki, Hisao  
2005 Prosody and phrase structure without labels. *English Linguistics* 22.2: 380–405.
- Trubetzkoy, Nikolai Sergejevič  
1939 *Grundzüge der Phonologie*, vol. 7, Travaux du Cercle linguistique de Prague. Prague: Le cercle linguistique de Prague.

Vydrine, Valentin

- 2004 K rekonstrukcii fonologičeskogo tipa i imennoy morfologii pramande. [Towards a reconstruction of the phonological type and nominal morphology of Proto-Mande] Manuscript, Russian Academy of Sciences, Institute of Linguistic Studies, St. Petersburg.

Wolf, Matthew

- 2007 For an autosegmental theory of mutation. In *University of Massachusetts Occasional Papers in Linguistics 32: Papers in Optimality Theory III*, Michael O'Keefe, Ehren Reilly and Adam Werle (eds.), 315–404. Amherst: Graduate Linguistics Student Association.

Wonderly, William L.

- 1951 Zoque II: phonemes and morphophonemes. *International Journal of American Linguistics* 17.2: 105–123.

Zwicky, Arnold

- 1984 Welsh soft mutation and the case of object NPs. In *Proceedings of CLS 20*, Joseph Drogo, Veena Mishra and David Testen (eds.), 387–402. Chicago: Chicago University Press.

